DIVISION 15 – MECHANICAL

ROTARY-SCREW WATER CHILLER PRE-PURCHASE SPECIFICATION
SECTION 15626

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The section "Special Requirements" forms a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full. The Contract Drawings and the Standard Form of Agreement apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Packaged, air-cooled chiller with remote evaporator.

B. Related Section:

1. Division 15 Section "Refrigerant Detection and Alarm" for refrigerant monitors, alarms, supplemental breathing apparatus, and ventilation equipment interlocks.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

C. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

D. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.

E. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tonsat any given set of rating conditions.

F. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than ARI standard rating conditions.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Site Altitude: Chiller shall be suitable for altitude in which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.

1. Performance at ARI standard conditions and at conditions indicated.
2. Performance at ARI standard unloading conditions.
3. Minimum evaporator flow rate.
4. Refrigerant capacity of chiller.
5. Oil capacity of chiller.
6. Fluid capacity of evaporator.
7. Characteristics of safety relief valves.
8. Minimum entering condenser-air temperature.
9. Maximum entering condenser-air temperature.
10. Performance at varying capacities with constant-design entering condenser-air temperature. Repeat performance at varying capacities for different entering condenser-air temperatures from design to minimum in 10 deg F increments.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Structural supports.
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

D. Certificates: For certification required in "Quality Assurance" Article.

E. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Source quality-control reports.

G. Startup service reports.

H. Operation and Maintenance Data: For each chiller to include in emergency, operation, and maintenance manuals.

I. Warranty: Sample of special warranty.

1.6 PROPOSAL REQUIREMENTS

A. Include standard delivery time and pricing as a base price. Provide the best delivery time and any associated cost premium. Delivery time shall be from the date of the signing of the purchase order to the day it will arrive on site. This time includes the submittal and approval process.

1.7 QUALITY ASSURANCE

A. ARI Certification: Certify chiller according to ARI 550 and ARI 590 certification program(s).

B. ARI Rating: Rate chiller performance according to requirements in ARI 550/590.

C. ASHRAE Compliance:

1. ASHRAE 15 for safety code for mechanical refrigeration.
2. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

E. ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.

F. Comply with NFPA 70.

G. Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ship chillers from the factory fully charged with refrigerant.

B. The chiller shall be manufactured and able to be delivered to the site as early as April 10, 2009. The chiller manufacturer shall coordinate the exact delivery date with the Mechanical Contractor's construction schedule. All expenses incurred by the Mechanical Contractor due to delay of delivery or damaged equipment shall be reimbursed by the chiller manufacturer.

C. The Mechanical Contractor shall be responsible for inspection of the equipment prior to acceptance. Once the Mechanical Contractor accepts the chiller, the Mechanical Contractor assumes all responsibility and liability for the equipment. If the equipment is damaged or unacceptable, the chiller manufacturer shall correct deficiencies cited or provide a brand new replacement unit pending Engineer's determination.

D. The Mechanical Contractor shall be responsible for rigging the equipment from the freight carrier.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.

1. Extended warranties include, but are not limited to, the following:

a. Complete chiller including refrigerant and oil charge.

2. Warranty Period: One year from date of Substantial Completion.

3. The compressor shall be warrantied for 5 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE SCHEDULE

AIR COOLED CHILLER WITH REMOTE EVAPORATOR SCHEDULE	
TAG	CH-1
SERVICE	CHILLED WATER
UNIT LOCATION	ON GRADE
NOMINAL CAPACITY	80
EER/IPLV/COP (ARI-550/590)	10.2/13.3/2.96
MAX. NOISE LEVEL AT A 3'-0" DISTANCE (DBA)	70
EVAPORATOR	
FLOW RATE (GPM)	240
MIN. FLOW RATE (GPM)	96
EWT/LWT (oF)	52/44
CAPACITY (MBH)	955.2
MAX. FLUID PRESSURE DROP (FT.)	19.0
FLUID TYPE	WATER
COMPRESSOR	
STAGES	15%-100% MOD.
COMPRESSOR TYPE	SCREW
COMPRESSORS (NO. @ RLA)	2@62.0

CONDENSER FAN (NO./HP/FLA)	8/1.25/2.5
REFRIGERANT	R-22
REFRIGERANT / CIRCUIT (LBS.)	61
REFRIGERANT (LBS.)	122
NO. OF CIRCUITS	2
AMBIENT TEMPERATURE (oF)	95
ELECTRICAL	
VOLTS/PH./HZ	460/3/60
MCA/MOP	160/200
POWER SOURCE	NORMAL
BASIS OF DESIGN (REF. ONLY)	
MANUFACTURER	TRANE
MODEL	RTAA-80
WEIGHT OUTDOOR UNIT (LBS.)	7500
WEIGHT REMOTE EVAPORATOR (LBS.)	800

*This chiller serves a system that has 3-way valves throughout a constant volume pumping system that completely bypasses chilled water at the fan coil units and fresh air unit that reduces the return water temperature.

2.2 PACKAGED, AIR-COOLED CHILLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trane; a division of American Standard.
2. YORK International Corporation.
3. Dunham Bush.

B. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, remote evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories. Remote evaporator shall be temporarily connected at the factory for the test and disconnected for shipment to the job site.

C. Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.

D. Cabinet:

1. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
3. Casing: Galvanized steel.

4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 1000 hour salt-spray test according to ASTM B 117.
5. Sound-reduction package designed to reduce sound level without affecting performance and consisting of the following:

    a. Acoustic enclosure around compressors.
    b. Reduced-speed fans with acoustic treatment.

E. Compressors:

1. Description: Positive displacement, hermetically sealed.
2. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
3. Rotors: Manufacturer's standard one- or two-rotor design.
4. Each compressor provided with suction and discharge shutoff valves, crankcase oil heater, and suction strainer.

F. Service: Easily accessible for inspection and service.

G. Capacity Control: On-off compressor cycling and modulating slide-valve assembly or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.

1. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
2. Operating Range: From 100 to 15 percent of design capacity.
3. Condenser-Air Unloading Requirements over Operating Range: Drop-in entering condenser-air temperature of 5 deg F drop for each 10 percent in capacity reduction.

H. Oil Lubrication System: Consisting of pump, filtration, heater, cooler, factory-wired power connection, and controls.

1. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
2. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
3. Factory-installed and pressure-tested piping with isolation valves and accessories.
4. Oil compatible with refrigerant and chiller components.
5. Positive visual indication of oil level.

I. Vibration Control:

1. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.

    a. Overspeed Test: 25 percent above design operating speed.

2. Isolation: Mount individual compressors on vibration isolators.

J. Compressor Motors:

1. Hermetically sealed and cooled by refrigerant suction gas.
2. High-torque, induction type with inherent thermal-overload protection on each phase.

K. Compressor Motor Controllers:

1. Wye-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition**,** or solid state.

L. Refrigerant Circuits:

1. Refrigerant: Type as indicated on Drawings.
2. Refrigerant Type: Classified as Safety Group A1 according to ASHRAE 34.
3. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
4. Refrigerant Circuit: Each shall include a thermal or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
5. Pressure Relief Device:

    a. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
    b. ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.

M. Remote Evaporator:

1. Description: Shell-and-tube design.

    a. Direct-expansion (DX) type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
    b. Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.

2. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Shell Material: Carbon steel.
4. Shell Heads: Removable carbon-steel heads located at each end of the tube bundle.
5. Fluid Nozzles: Terminated with flanged end connections for connection to field piping.
6. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
7. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.
8. The evaporator shall not be any longer than 128”.

N. Air-Cooled Condenser:

1. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.

    a. Construct coil casing of galvanized steel.
    b. Construct coils of copper tubes mechanically bonded to aluminum fins.
    c. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.

3. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.

O. Electrical Power:

1. Factory-installed and wired disconnect switch, motor controllers, transformers, and other electrical devices necessary shall provide a single-point with disconnect switch, field-power connection to chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with padlock and key.
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field-power interface shall be to NEMA KS 1, heavy-duty, nonfused disconnect switch.

    a. Disconnect means shall be interlocked with door operation.
    b. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 65,000.

6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:

    a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
    b. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.

7. Provide each motor with overcurrent protection.
8. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
9. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
10. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.

    a. Power unit-mounted controls where indicated.
    b. Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.

11. Control Relays: Auxiliary and adjustable time-delay relays.
12. For chiller electrical power supply, indicate the following:

    a. Current and phase to phase for all three phases.
    b. Voltage, phase to phase, and phase to neutral for all three phases.
    c. Three-phase real power (kilowatts).
    d. Three-phase reactive power (kilovolt amperes reactive).
    e. Power factor.
    f. Running log of total power versus time (kilowatt-hours).
    g. Fault log, with time and date of each.

P. Controls:

1. Microprocessor based with a BACNet or Lon interface to the Johnson Control System provided by OZ Controls. The interface shall communicate all points and alarms that the on-board chiller controls monitor or control. Critical operating setpoints may be read only.
2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure.
3. Provide an operator interface at the chiller and a remote operator interface in the chiller room that houses the evaporator in the basement.
4. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:

    a. Date and time.
    b. Operating or alarm status.
    c. Operating hours.
    d. Outdoor-air temperature if required for chilled-water reset.
    e. Temperature and pressure of operating set points.
    f. Entering and leaving temperatures of chilled water.
    g. Refrigerant pressures in evaporator and condenser.
    h. Saturation temperature in evaporator and condenser.
    i. No cooling load condition.
    j. Elapsed time meter (compressor run status).
    k. Pump status.
    l. Antirecycling timer status.
    m. Percent of maximum motor amperage.
    n. Current-limit set point.
    o. Number of compressor starts.
    p. Operating power (kw).

5. Control Functions:

    a. The chiller shall be scheduled and enabled/disabled by the Johnson Control System by OZ Controls.
    b. Entering and leaving chilled-water temperatures, control set points, and motor load limits shall be readable by the Johnson Control System by OZ Controls.
    c. Chilled-water leaving temperature shall be reset based on a signal from the Johnson Controls System by OZ controls.
    d. Current limit and demand limit.
    e. External chiller emergency stop.
    f. Antirecycling timer.
    g. Variable evaporator flow.

6. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:

    a. Low evaporator pressure or high condenser pressure.
    b. Low chilled-water temperature.
    c. Refrigerant high pressure.
    d. High or low oil pressure.
    e. High oil temperature.
    f. Loss of chilled-water flow.
    g. Control device failure.

7. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
8. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
9. Control Authority: Four control conditions: Off, local manual control at chiller, local standalone chiller control and automatic control through a remote source.
10. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.

    a. Hardwired Points:

        1) Monitoring: On-off status, common trouble alarm.
        2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment.
        3) Refer to the sequence of operation for additional control points required to be available.

    b. ASHRAE 135 (BACnet) or LonTalk communication interface as required by the Johnson Control System by OZ Controls shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS. Refer to the sequence of operation for additional control points required to be available.

Q. Insulation:

1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
2. Thickness: 1-1/2 inches.
3. Factory-applied insulation over cold surfaces of chiller components.

    a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.

4. Apply protective coating to exposed surfaces of insulation to protect insulation from weather and UV exposure.

R. Accessories:

1. Factory-furnished, chilled-water flow switches for field installation.
2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
3. Provide condenser fan sound attenuating shrouds and sound attenuating wraps for compressors, piping, etc. to meet the specified sound criteria measured 3’-0” from the sides and top of the unit.

2.3 SOURCE QUALITY CONTROL

A. Perform functional tests of chillers before shipping.

B. Factory run test each air-cooled chiller with water flowing through evaporator.

C. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. For chillers located outdoors, rate sound power level according to ARI 370.

PART 3 - EXECUTION

3.1 STARTUP SERVICE

A. Provide a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
3. Verify that pumps are installed and functional.
4. Verify that thermometers and gages are installed.
5. Operate chiller for run-in period.
6. Check bearing lubrication and oil levels.
7. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
8. Verify proper motor rotation.
9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator.
11. Verify and record performance of chiller protection devices.
12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.

C. Prepare test and inspection startup reports.

3.2 DEMONSTRATION

A. Provide a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers.

END OF SECTION 15626